

## Blended Wing Body

Someday airplanes may have blended wing bodies. This revolutionary aircraft design includes the engines, wings, and body in one structure that provides the aircraft's lift. A double-deck passenger compartment would blend into the wings and would hold 800 persons.

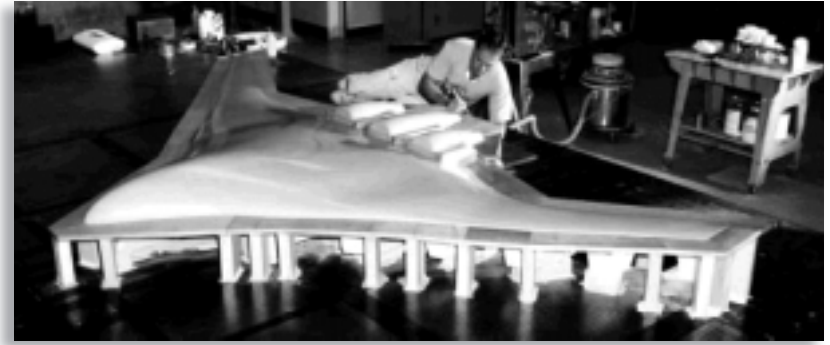


<http://oea.larc.nasa.gov/PAIS/BWB.html>



## Aircraft Design Research

To make the Blended Wing Body closer to becoming a reality, extensive model development and testing must be done. Here a technician works on a 3.3-meter-wide BWB wind tunnel test model. Data will be collected to determine the performance and stability of the current design.

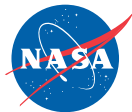


<http://aerospace.nasa.gov>



## F-15 ACTIVE

The Advanced Control Technology for Integrated Vehicles (ACTIVE) program at NASA's Dryden Flight Research Center is a research effort to enhance the performance and maneuverability of future civil and military aircraft. For this program, advanced flight control systems and thrust vectoring of engine exhaust have been built into a highly modified F-15 research aircraft.



<http://www.dfrc.nasa.gov/PAO/PAIS/HTML/FS-048-DFRC.html>



## Aircraft Performance Research



The ACTIVE research team uses a modified F-15 jet to improve the way aircraft perform and maneuver. The newly developed nozzles can redirect the engine exhaust up, down, left, and right.



<http://aerospace.nasa.gov>



## Helios Prototype

The Helios Prototype is a remotely piloted aircraft being developed to prove that a solar-powered aircraft can fly a maximum altitude of 30.5 km or can maintain an altitude of at least 15.2 km for a minimum of 4 days. It is being developed as part of NASA's Environmental Research and Sensor Technology (ERAST) project.



<http://www.dfrc.nasa.gov/PAO/PAIS/HTML/FS-068-DFRC.html>



## Solar-Powered Aircraft Research

The Pathfinder Plus is an earlier design in the evolution of solar-powered research aircraft. Such high-flying, remotely piloted aircraft could be used to track storms, sample the atmosphere, take spectral images for agricultural purposes, monitor natural resources, and act as a telecommunications relay platform.



<http://www.dfrc.nasa.gov/PAO/PAIS/HTML/FS-034-DFRC.html>



## X-37

The X-37 will be the first of NASA's fleet of experimental, reusable launch vehicles to operate in orbit and during reentry into Earth's atmosphere. The Space Shuttle or rockets will be able to ferry the X-37 into orbit. There it will operate at speeds of up to 25 times the speed of sound and test technologies in the harsh environments of space and atmospheric reentry.



<http://www.msfc.nasa.gov/news/background/facts/x37.htm>



## Launch and Reentry Research



As in the artist's concept drawing, scientists hope to do future testing of the X-37 like this, transporting it in the Space Shuttle cargo bay to do reentry testing. The X-37 is being developed to test airframe, propulsion, and operational technologies for reusable launch vehicles.



<http://www.aerospace.nasa.gov/>



## International Space Station



The ISS represents a global partnership of 16 nations. It will be a permanent orbiting laboratory enabling long-duration research in the unique microgravity environment of Earth's orbit. When fully assembled, the ISS will look like the picture shown here.



<http://spaceflight.nasa.gov/station/>



## Life Science Research



Biotechnology facilities aboard the ISS will include a bioreactor developed by NASA for 3-D tissue growth. Growing tissues in the bioreactor in microgravity produces structures, such as polyps and glands (middle and bottom), which are not present in petri dish cultures (top) grown on Earth. Onorbit cellular research has the potential to help treat diseases such as AIDS, diabetes, and cancer.



<http://microgravity.msfc.nasa.gov/>



## KC-135



The KC-135 is a microgravity research aircraft nicknamed the "Vomit Comet." It is used to fly in parabolas to induce weightless conditions for 15 to 20 seconds at a time. When some of the effects of gravity are reduced, other phenomena are more easily observed.



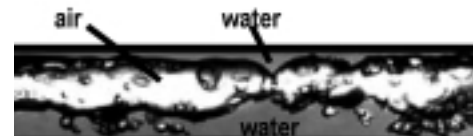
<http://microgravity/kjenks/kc-135.htm>



## Fluids Research



Pipe with water and air in 1g conditions



Pipe with water and air in microgravity

Fluids research conducted on the KC-135 reveals that air and water do not flow through a pipe in microgravity in the same way that they do on Earth—with water, which is denser than air, on the bottom and air on top. In microgravity, density differences do not cause materials to layer. Bubbles and "slugs" of air flow throughout the water. Liquids do not fill the bottom of a container. Fluid studies such as this impact the design of spacecraft fuel tanks and water transfer systems.



<http://microgravity.msfc.nasa.gov/>



## Space Shuttle



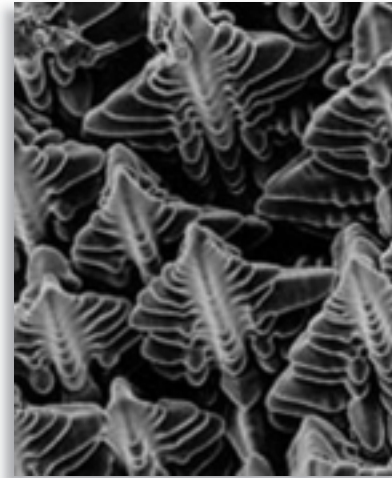
The Space Shuttle is NASA's reusable launch vehicle that is used to conduct scientific research in the unique environment of Earth's orbit, and to help construct the International Space Station. This picture shows the cabin of the Space Shuttle Atlantis, its remote manipulator system (RMS) arm in operational mode, and a part of the International Space Station during Shuttle mission STS-106.



<http://spaceflight.nasa.gov/shuttle/>



## Materials Science



This image shows a "forest" of dendrites, which are fern-like microstructures found in metals. Materials scientists study dendrites in space to improve the output of foundries here on Earth. Scientific data from the Isothermal Dendritic Growth Experiment are being adapted into computer models, thus reducing the casting design process from a couple of weeks to about a day.



<http://microgravity.nasa.gov/MS.html>



## Sounding Rockets



Sounding rockets, such as the Black Brant shown here, are used for a broad range of scientific research. These rockets top out in the Thermosphere before falling back to Earth. Once the engine thrust is cut off, rocket payloads are in freefall and experience microgravity conditions for 6 to 10 minutes. At this point, a parachute deploys to slow the payload's descent.



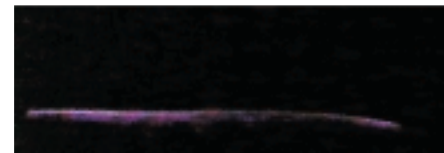
<http://rscience.gsfc.nasa.gov/>



## Combustion Research



Flame spread in an Earth-based laboratory



A more-controlled flame spread under microgravity conditions

Combustion scientists hope that by studying flame spread in a microgravity environment, they will gain a deeper understanding of how fire burns and of potential fire hazards onorbit. Because combustion phenomena occur quickly, much research is done in drop towers and on sounding rockets.



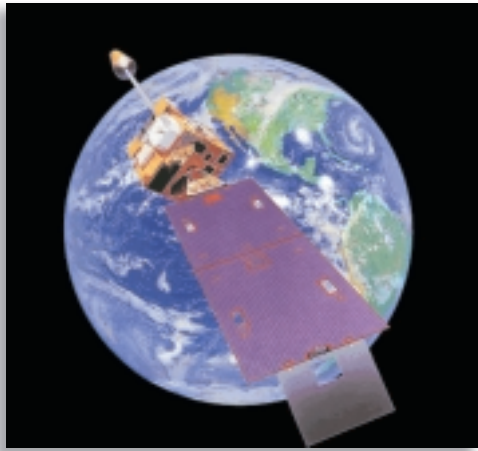
<http://microgravity.grc.nasa.gov/expr3/combust.htm>





## GOES

### Geostationary Operational Environmental Satellite



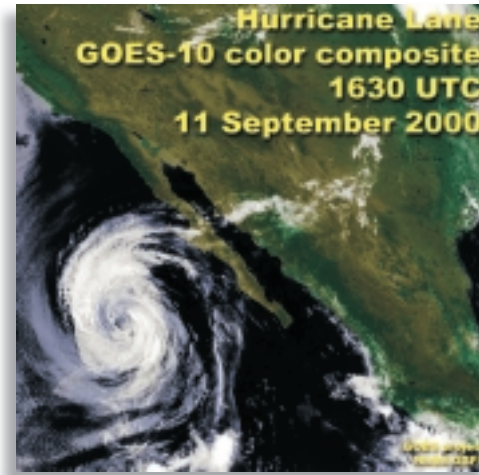
The Geostationary Operational Environmental Satellite (GOES) is a key part of U.S. weather monitoring and severe storm forecasting. GOES orbits high above the equator at 36,000 km, and it remains above a specific point on Earth's surface in what is known as a geostationary orbit. The high altitude allows the satellite to observe a large area, such as the entire continental United States, and to continually monitor weather systems in that area.



<http://goes2.gsfc.nasa.gov/>



## Weather Monitoring



This picture of a hurricane coming up from the southwest of the Baja peninsula is a composite image. The GOES satellite took the cloud image in visible and thermal infrared, while the colorized background is a Landsat composite map.



<http://rsd.gsfc.nasa.gov/goes/text/hotstuff.html>



## Terra



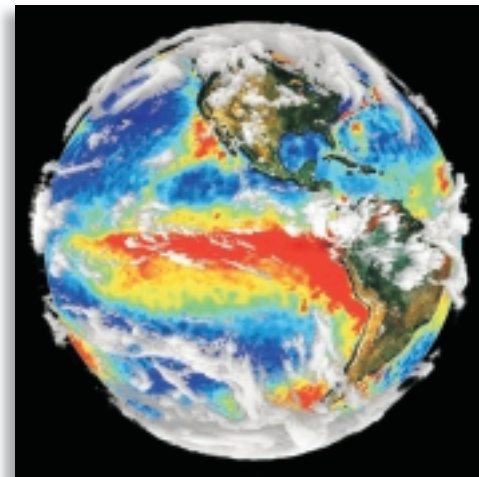
Terra is NASA's flagship Earth observing satellite. In February 2000 it began collecting global data on Earth's climate. Terra will circle around Earth, very nearly from pole to pole. The data it collects are analyzed to determine the cause-and-effect relationships among Earth's lands, oceans, and atmosphere well enough to predict future climate conditions.



<http://terra.nasa.gov/>



## Global Climate Change



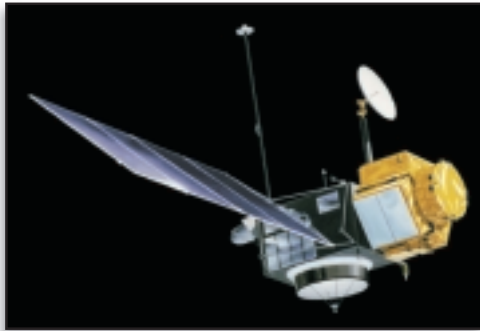
This graphic shows data collected from Terra's multiple sensors integrated into one image. The three-dimensional cloud measurements were taken by one sensor. Another sensor collected ocean temperatures. The red area in the Pacific Ocean shows an El Niño anomaly. Red dots on land show the locations of forest fires. Together, Terra's instruments help us understand Earth as a whole, integrated system.



<http://visibleearth.nasa.gov/Sensors/Terra/>



## TOPEX/Poseidon



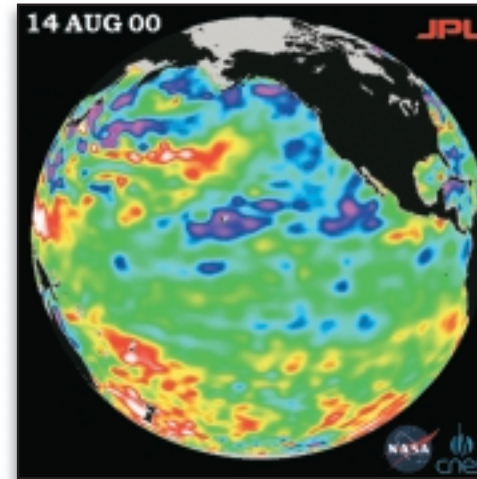
Every 10 days, the TOPEX/Poseidon satellite measures global sea level with unparalleled accuracy and monitors global ocean circulation. These studies reveal ties between the oceans and atmosphere and improve global climate predictions.



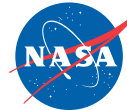
<http://topex-www.jpl.nasa.gov/>



## Ocean Climatology



After three years of devastating El Niño and La Niña climate patterns, the Pacific Ocean is finally calming down to near normal sea levels (green). Above-normal sea-level heights appear in red and white, ranging from 10 to 32 cm. Blue and purple areas indicate below-normal levels, from 4 to 18 cm.

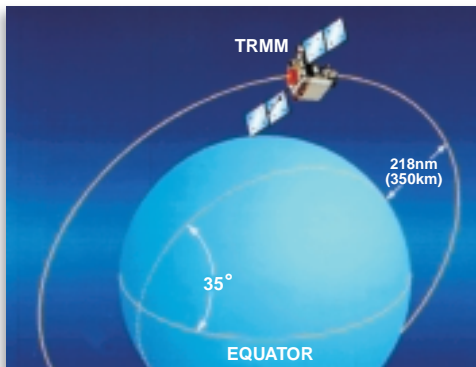


<http://www.jpl.nasa.gov/elniño/>



## TRMM

### Tropical Rainfall Measuring Mission



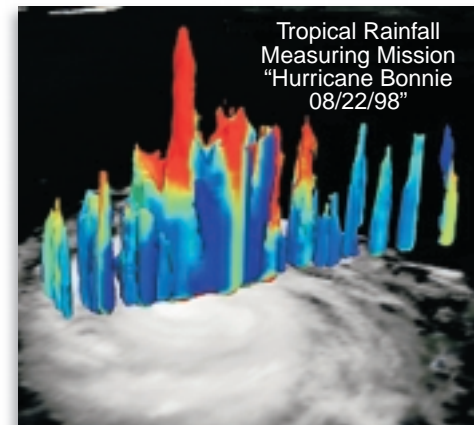
The Tropical Rainfall Measuring Mission (TRMM) is a joint mission between NASA and the National Space Development Agency (NASDA) of Japan. It was designed to monitor and study tropical rainfall and the associated release of energy that helps power global atmospheric circulation, which shapes both weather and climate around the globe.



<http://trmm.gsfc.nasa.gov/>



## Storm Studies



One of the unique features of TRMM's instrumentation is that it allows scientists to peer inside clouds. Using radar, scientists study the reflection of cloud drops, raindrops, and ice crystals within various parts of the energy spectrum, and they construct a picture of what the cloud looks like inside. TRMM's ability to distinguish between various ice and water particles in storms is beginning to shed light on how and why lightning is produced.



[http://trmm.gsfc.nasa.gov/Ed\\_Resources.html](http://trmm.gsfc.nasa.gov/Ed_Resources.html)



## BOOMERanG

### Balloon Observations of Millimetric Extragalactic Radiation and Geophysics

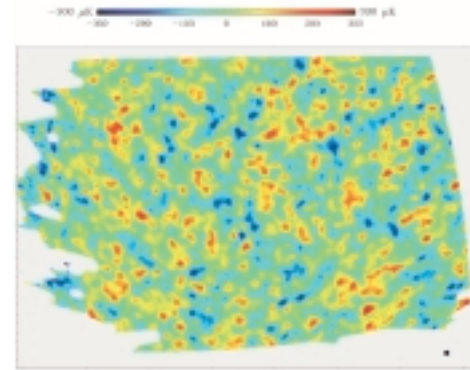
For 10 days in 1998, BOOMERanG, a balloon-borne telescope, circumnavigated Antarctica at an altitude of 32 km, which is above much of Earth's atmospheric mass. The telescope collected data about the early universe.



<http://www.wff.nasa.gov/pages/scientificballoons.html>



## Early Universe Research



In this picture, we see the universe as it makes its transition from a glowing plasma to a transparent gas, approximately 14 billion years ago. The color scale of the image has been enhanced to bring out the temperature variations in the primordial plasma, which has since evolved into giant clusters and superclusters of galaxies today.

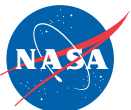
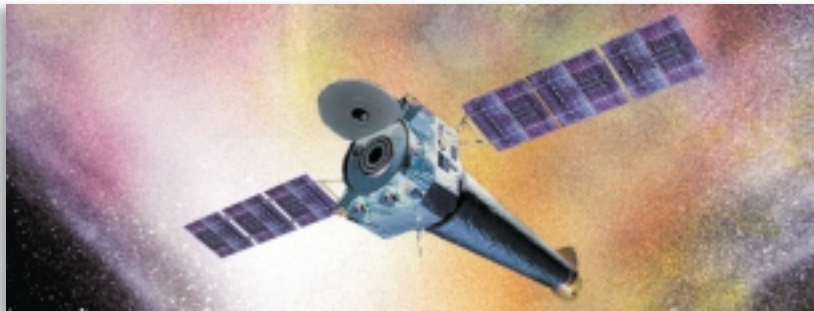


<http://www.physics.ucsb.edu/~boomerang/>



## Chandra Space Observatory

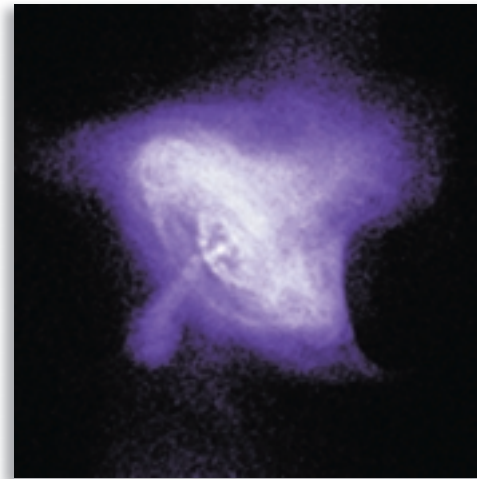
The Chandra X-ray Observatory was launched in 1999 and is NASA's newest Great Observatory. Chandra detects and images x-ray sources that are billions of light-years away. The images from Chandra are twenty-five times sharper than the best previous available. Chandra provides more detailed studies of black holes, supernovae, and dark matter.



<http://chandra.harvard.edu/>



## X-Ray View of the Crab Nebula



The Crab Nebula is the remnant of a supernova explosion that was seen on Earth in A.D. 1054. It is 6,000 light-years from Earth. At the center of the bright nebula is a rapidly spinning neutron star, or pulsar, that emits pulses of radiation 30 times a second.



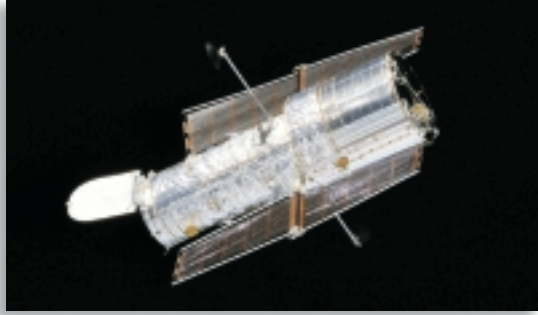
<http://chandra.harvard.edu/photo/0052/index.html>





## Hubble Space Telescope

Launched in 1990, the Hubble Space Telescope was the first major telescope to be placed into orbit around Earth, high above Earth's obscuring atmosphere. Its mission is to provide the clearest views of the universe possible using optical astronomy. Hubble's telescope can resolve astronomical objects with an angular size of 0.05 arc seconds, which is like seeing a pair of fireflies in Tokyo from Maryland.



<http://hubble.stsci.edu/>



## Colliding Galaxies



What appears as a bird's head leaning over to eat a meal is a striking example of a galaxy collision in NGC 6745. The "bird" is a large spiral galaxy. Its "prey" is a smaller passing galaxy (lower right). The bright blue beak and bright, whitish-blue top feathers show the distinct path taken during the smaller galaxy's journey. These galaxies did not merely interact gravitationally as they passed one another; they actually collided.



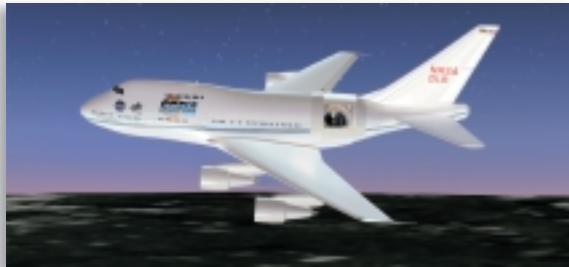
<http://oposite.stsci.edu/pubinfo/latest.html>



## SOFIA

### Stratospheric Observatory for Infrared Astronomy

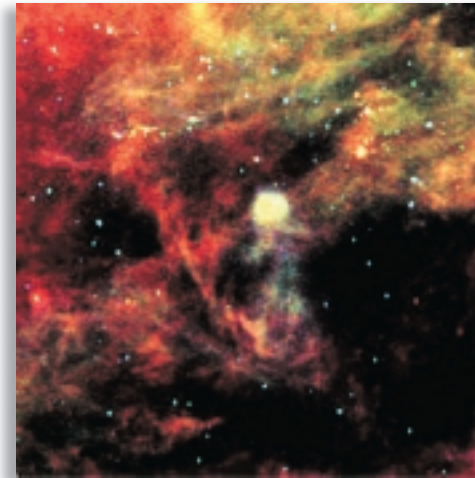
The U.S. and German space agencies are developing the Stratospheric Observatory for Infrared Astronomy (SOFIA), a 747SP aircraft that carries a 2.5-m reflecting telescope. SOFIA will be the largest airborne telescope in the world. It will make observations that are impossible for even the largest and highest ground-based telescopes. Its planned cruising altitude of 12.5 km puts it above the water vapor in the Troposphere, which absorbs infrared radiation.



<http://sofia.arc.nasa.gov/>



## Infrared Astronomy



Astronomical objects emit many forms of energy which neither the human eye nor ordinary telescopes can detect. Infrared is one form of this invisible energy. Infrared radiation can pass through dusty regions of space without being scattered. This means we can study objects hidden by gas and dust which we cannot see in visible light, such as the center of our galaxy and regions of newly forming stars.



<http://www.ipac.caltech.edu/Outreach/Edu/>

